PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 62723A	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/US2004/000962	International filing date *(day/month/year)* 15.01.2004	Priority date *(day/month/year)* 05.02.2003
International Patent Classification (IPC) or national classification and IPC C08F279/02		
Applicant DOW GLOBAL TECHNOLOGIES INC. et al.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 2 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☒ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
23.08.2004	10.12.2004
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Wirth, M Telephone No. +49 89 2399-8595

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/US2004/000962

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-9, 11, 12	as originally filed
10	filed with telefax on 12.07.2004

Claims, Numbers

1-19	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☒ the description, pages 10
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-19
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-19
Industrial applicability (IA)	Yes:	Claims	
	No:	Claims	1-19

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item I

Basis of the report

The applicant intended to modify page 10 of the description because it contained a mistake: the functionality of the rubber in comparative example 1 should have read "I" instead of "none".
The corresponding amendment can not be allowed since it has no support in the application as filed (Art 34 (1)(b) PCT). The error can not be considered as an "obvious error" in the sense of Rule 91.1 (a) PCT as it is not clear from the application as filed that nothing else could have been intended (Rule 91.1 (b) PCT).
The applicant also proposed to delete the last column of table 1 and its footnote. This is also not allowable as it would render the examples incomplete and unclear and the person skilled in the art would not be in a position to reproduce them (Art 5 and 6 PCT).

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

   D1: WO 00/55211 A (ATOCHEM ELF SA ;BERTIN DENIS (FR); BOUTILLIER JEAN MARC (FR)) 21 September 2000 (2000-09-21)
   D2: US-A-5 721 320 (LI IRENE Q ET AL) 24 February 1998 (1998-02-24) cited in the application
   D3: US-B1-6 255 402 (FORGES NATHALIE ET AL) 3 July 2001 (2001-07-03) cited in the application
   D4: WO 99/62975 A (ATOCHEM ELF SA ;BOUTILLIER JEAN MARC (FR)) 9 December 1999 (1999-12-09) cited in the application

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-19 is not new in the sense of Article 33(2) PCT.

   The document **D1** discloses (the references in parentheses applying to this

document):

a polymerization process wherein a rubber carrying functional groups enabling controlled radical polymerization is reacted with styrene. The rubber has a solution viscosity in styrene at 25°C of 20-350 cps (see claims 1 and 8).The value of 20 cps is specifically disclosed in claim 8 so that the argument that the claimed value "less than 50 cps" would be a selection is not valid. The process enables to control the morphology of the particles in the matrix and the modified rubber has improved impact resistance, gloss and transparency. A bimodal particle size is obtained (see examples 13 and 14).

Present claims 1-19 are therefore not novel over D1.

D2 also discloses the same process as in the present application (see claim 1). The viscosity of the rubber is not mentioned in D2. However, in example 1, a functionalised rubber having a Mw of 3930 is reacted with styrene. The viscosity of this rubber is within the claimed range.

Present claims are therefore not novel over D2.

D3 also discloses the same process as in the present application (see claim 1). The modified rubber has improved gloss and impact resistance. The viscosity of the rubber is not mentioned in D3. Its molecular weight range is broad and the rubber used in the examples does not fall under present claims. Novelty over D3 is therefore acknowledged.

D4 discloses a process to prepare a rubber modified polystyrene wherein a rubber, styrene and a stable free radical. The process of D4 is therefore different from the now claimed process since the rubber is not functionalised before the introduction of styrene.

The obtained product (high impact polystyrene) is however the same as the product claimed in present claim 18. In particular, The viscosity of the rubber is under 50 cps (claim 19 and ex 5). No difference can be made between the polymers of D4 and the claimed polymers.

Present claims 18 and 19 are therefore not considered novel over D4 (see PCT International search and Preliminary examination Guidelines, p 50, A5.26[2]).

short side of the mold. During injection molding, the injection pressure switches to holding pressure when the cavity pressure reaches the pre-set value. The pressure transducer is located at a distance of 19.2 mm from the injection point.

The polishing of the mold is according to SPI-SPE1 standard of the Society of Plastic Engineers.

Solution viscosity is measured in 5 wt. percent solution in styrene at 25°C.

RPS (rubber particle size) is measured using Coulter Counter (20μm orifice).

SB (styrene-butadiene) block copolymers are produced according to the process described in US Patent 5,721,320 (Priddy).

Examples 1-3

A continuous polymerization apparatus composed of three 2.4 liter plug flow reactors connected in series, wherein each plug flow reactor is divided in three zones of equal size, each zone having a separate temperature control and equipped with an agitator (temperature settings of 107/110/114°C with an agitator speed of 120 rpm; 114/116/120°C with an agitator speed of 120 rpm; 125/140/150°C with an agitator speed of 30 rpm respectively), is continuously charged with a feed composed of 12 parts by weight of rubber, 55.5 parts by weight of styrene, 17.5 parts by weight of acrylonitrile and 15 parts by weight of ethyl benzene at a rate of 900 g/hr. The initiator, 1,1-di(t-butyl peroxy) cyclohexane and is added to the top of the first reactor. N-dodecylmercaptan (NDM)(chain transfer agent) is added to optimize the rubber particle sizing and the matrix molecular weight. Table 2 contains further details with respect to run conditions and properties.

After passing through the 3 reactors, the polymerization mixture is guided to a separation and recovery step using a preheater followed by a devolatilizing extruder. Finally the molten resin is stranded, cooled and cut in granular pellets. Four different functionalized rubbers are used (Table 1) to evaluate the sizing characteristics under various conditions (optimizing initiator and chain transfer concentration).

Table 1

	Styrene/butadiene Rubbers	Sol.Visc. (cps)	Styrene content of rubber (wt. %)
Example 1	A	10	30
Example 2	B	25	15
Example 3	C	33	30
Comp. Ex. 1	D	52	10

AMENDED SHEET

short side of the mold. During injection molding, the injection pressure switches to holding pressure when the cavity pressure reaches the pre-set value. The pressure transducer is located at a distance of 19.2 mm from the injection point.

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Solution viscosity is measured in 5 wt. percent solution in styrene at 25°C.

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After passing through the 3 reactors, the polymerization mixture is guided to a separation and recovery step using a preheater followed by a devolatilizing extruder. Finally the molten resin is stranded, cooled and cut in granular pellets. Four different functionalized rubbers are used (Table 1) to evaluate the sizing characteristics under various conditions (optimizing initiator and chain transfer concentration).

Table 1

	Styrene/butadiene Rubbers	Sol.Visc. (cps)	Styrene content of rubber (wt. %)	Functionality on the rubber
Example 1	A	10	30	I
Example 2	B	25	15	I
Example 3	C	33	30	I
Comp. Ex. 1	D	52	10	I

I) 2,2,6,6-tetramethyl-1-[1-[4-(oxiranylmethoxy)phenyl]ethoxy]-piperidine